Item	Description	design effort (hrs)	eng effort (hrs)	technician effort [hrs]	Base M&S (k$)	Base Labor SWF (k$)	Base Labor SWF with indirect (k$)	Labor with indirect and M&S (k$)	contingency (%)	TPC (Base labor w ind,M&S and contingency) (k$)
Design,Proc & Installation					240.0	132.9	230.8	470.8	50	704.6
Design						120.2	208.7	208.7		311.7
3D CAD Integration model	Create a CAD model of the ORKA detector (essential features), the support rails in the CDF detector, including the rail connections and the clearance machining of the end wall modules . Create a CAD model of the installation cart. May also need some simplified CAD models of the existing CDF fixtures that will be reused. Study the clearances and fits with as-built tolerances for the CDF detector. Confirm installation steps to install the support rails and the ORKA detector. **Includes time to build or convert some CDF detector elements from the IDEAS CAD system to the NX CAD system**	400	60		-	28.8	50.1	50.1	60	80.1
Support rails design	Detail design of the stainless steel support rails including features to minimize the manufacturing cost. The rail may be constructed from welded or bolted sections and investigating and comparing these options is part of this task. Perform Finite Element analysis of the rails including the rail connections. The task also includes preparing an engineering note for the structural analysis.	160	160		-	22.6	39.3	39.3	40	55.1
Support rail connections	Detail design of the modifications to the CDF Yoke end wall for mounting connections of the end rails. Will include the design of any fixtures or drill templates needed for the field modification work.	80	40		-	8.1	14.0	14.0	40	19.6
End Wall Modification Design	Detail design of modifications of the End Wall Modules to accommodate the space required for the support rails. The modifications are expected to consist of machined notches that create a 2" deep pocket near on the face of the module which mounts to the Yoke end wall. May include modifications to the cover details and some mounting holes. The modifications are not expected to have a major structural impact on the module but some analysis may be required. Will include preparing an engineering note for the module modification if there are significant structural changes.	40	20		-	4.0	7.0	7.0	40	9.8
Support rails installation addition to COT installation fixture	This task involves designing a fixture that can be added to the COT installation fixture to hold and position the support rails while they are connected inside the bore of the CDF detector. This fixture is likely an addition to the support boom so that it can hold the support rails and provide some lateral motion to move them into the final position. The task includes preparing an engineering note for the fixture and a preparing a written procedure for the installation of the rails. It is assumed that the original COT fixture is still available.	160	80		-	16.1	28.0	28.0	40	39.2
Installation Cart	This task involves detail design of a cart with rail segments to use for transporting and installing the ORKA detector. The cart will be used to transport the detector from the CDF assembly hall to the collision hall. The cart will also have features to install of the detector inside the bore of the CDF detector on the support rails. The cart will have rail segments that mimic the stainless steel support rails that will be mounted prior to the detector installation. The frame that holds the will hold the detector in the stainless steel rails will mount to the rails on the cart in the same way. The cart also has telescoping legs that will be in the detector and cart rails to be raised to the proper elevation to align with the bore of the CDF detector. The task includes the selection of the hydraulic cylinders and their push connections for raising the detector to the proper elevation and for sliding the detector on to the permanent rails. It also include the bearing/sliding selection for the motion of the detector along the rail. The task includes preparing an engineering note for the cart and a preparing a written procedures for moving the detector into the collision hall and sliding the detector into the final position.	240	160		-	27.4	47.6	47.6	60	76.2
End Wall Module Installation fixture Engineering Note and Procedure (if required)	This task involves preparing an engineering note for the end wall module fixture and preparing a procedure for the use of the fixture to remove and reinstall the end wall modules. This may not be required if this documentation already exists. It is assumed that the original End Wall Module fixture is still available.	0	40		-	3.3	5.7	5.7	40	7.9
Detailed magnetic field analysis (if required)	This task involves detailed magnetic analysis beyond the axis symmetric magnetic modeling that has already been done.	0	120		-	9.8	17.0	17.0	40	23.8

Item	Description	design effort (hrs)	eng effort (hrs)	technician effort [hrs]	Base M&S (k$)	Base Labor SWF (k$)	Base Labor SWF with indirect (k$)	Labor with indirect and M&S (k$)	contingency (%)	TPC (Base labor w ind,M&S and contingency) (k$)
Procurement					240.0	12.7	22.1	262.1		392.9
Support rail procurement	This task includes the M&S cost for 2 stainless steel support rails and the procurement support effort. The shape of the midspan may need to be a rectangular shape to be within this cost estimate.		60		122.0	4.9	8.5	130.5	50	195.8
Support rail connection tooling procurement	This task includes the M&S cost for the modest tooling and the procurement support effort		8		2.0	0.7	1.1	3.1	40	4.4
Support rail installation fixture procurement	This task includes the M&S cost for the rail installation fixture and the procurement support effort		24		10.0	2.0	3.4	13.4	50	20.1
End Wall module modification at Village Machine Shop	This task includes the M&S cost for the modifying 8 End Wall Modules in the Village Machine Shop		24		16.0	2.0	3.4	19.4	50	29.1
Installation Cart Procurement	This task includes the M&S cost for the installation cart and the procurement support effort		40		90.0	3.3	5.7	95.7	50	143.5
Installation						0.0	0.0	0.0		0.0
Move the Central Detector to Assembly Hall	CDFII Procedure 404			0	-	0.0	0.0	0.0	40	0.0
Move Central Arches Out	Move Central Arches out of central detector to provide access to End Wall Module connections. CDF II Procedure 406			0	-	0.0	0.0	0.0	40	0.0
Remove 8 End Wall Modules near horizontal center	Remove 8 End Wall Modules near horizontal center for modification. Procedure ? Use fixture MD-134416			0	-	0.0	0.0	0.0	40	0.0
Remove detector elements from End Wall Modules	Remove detector elements from End Wall Modules and send to Village Machine Shop for modification			0	-	0.0	0.0	0.0	40	0.0
Remove ISL	Remove the ISL from the center of the COT. Procedure ?			0	-	0.0	0.0	0.0	40	0.0
Remove COT	Attach the H-frames to the ends of the COT and remove the COT with the long boon fixture. Procedure ?			0		0.0	0.0	0.0	40	0.0
Install 2 stainless steel support rails	Install the 2 stainless steel support rails using the boom fixture used for the COT. An additional feature will need to be added to the allow transverse movement of the support rail.			0		0.0	0.0	0.0	40	0.0
Reinstall 8 End Wall Modules	Reinstall 8 End Wall Module with notches machined to clear ends of stainless steel support rails . Procedure ?			0		0.0	0.0	0.0	40	0.0
Move Central Arches back in to central detector	Move Central Arches back in to central detector. CDF II Procedure 406			0		0.0	0.0	0.0	40	0.0
Assemble the ORKA detector on the installation cart	Assemble the ORKA detector in section that are within the 50 ton building crane capacity on to the installation cart			0		0.0	0.0	0.0	40	0.0
Move the Installation cart with ORKA detector into the collision hall	Using the "transporter" move the installation cart into the collision hall, using Hillman rollers and existing cylinders. Chains and building tie points move the installation cart near the final position			0		0.0	0.0	0.0	40	0.0
Raise the detector and align the extension rails with the support rails	Raise the detector and align the extension rails with the support rails			0		0.0	0.0	0.0	40	0.0
Slide the ORKA detector on to the support rails	Slide the ORKA detector on to the support rails			0		0.0	0.0	0.0	40	0.0
Subtotals (hours)		1080	836	0						
man-days		135	104.5	0						
Labor SWF subtotals		64604	68323	0						
Labor SWF with overhead subtotals		112185	118642	0						
					check	132927	230827			